N.A.C.A. BULLETIN

In Two Sections

Section One

BUDGETS FOR COST CONTROL
by DAVID B. CAMINEZ 303

THE INDUSTRIAL ENGINEER, THE COST ACCOUNTANT, AND LABOR STANDARDS
by JOHN W. SHEETZ 316

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EDITORIAL DEPARTMENT NOTE

The swift removal of most wartime governmental controls over business is expected to hasten the free operation of a competitive economy. Under such conditions budgetary control becomes a vital and stabilizing element in business planning.

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Besides budgetary planning there is the planning involved in the setting of standards. This task is shared jointly by the industrial engineer and the cost accountant. The nature of the task is described in the second article in this issue.

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NOVEMBER 1, 1946

BUDGETS FOR COST CONTROL

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IT IS A tribute to the N. A. C. A. that during the International Cost Conference which was held in Chicago in June 1944—a little less than three weeks after D-Day—it had the foresight to devote one whole day to the subject of "Cost Accounting in Tomorrow's Competitive Market". Now that we are on the threshold of competitive markets, there are many imposing problems that industry faces.

When the production lines really get rolling and there is a better balance between supply and demand we will be back to a competitive economy; back to a price-minus basis. The correct formula always has been "selling price less a reasonable profit equals the cost objective" rather than "cost plus profit equals selling price."

We hear and read a great deal about high, continuous employment, high wages, and low prices, which is the recipe for a high standard of living. But that desirable goal will be possible only if we can get high productivity. When we talk about high productivity some people get the mistaken notion that we mean the speed-up or the sweat shop. On the contrary, we mean a fair day's work according to reasonable standards of efficiency on the part of all employees, productive and nonproductive, hourly and salaried, using to best advantage the available facilities, tools, and material.

In the final analysis, that is the objective of cost control, to get the greatest amount of production from a given amount of manpower, materials, and facilities. The vehicle for accomplishing this economically desirable objective is the budget, whereby reasonable standards are established in advance so that this end result may be realized. The subject of "Budgets for Cost Control" divides itself naturally into three parts:

1. The profit and loss budget.
2. Control of manufacturing costs.
3. Physical unit budgets for implementing factory cost control.

Budgeting is a poor substitute for planning. Unless an organization is able to plan its operations in advance and establish

reasonable standards of operating performance, the controller or industrial accountant would have to be Houdini himself to establish satisfactory budgets. The accounting organization should be of vital assistance in planning the operations. After the plans are all completed, it will interpret the plans into financial results to determine (1) whether or not the answer is satisfactory, (2) how the plans or standards should be altered, and (3) the objective to be attained.

Sales Forecast

The profit and loss budget is not the plan, but the result of planned operations. The first step in compiling the profit and loss budget consists of the preparation of a sales forecast. It is the backbone of all operational planning, including the planning of facilities and personnel. This information should be presented for normal or standard volume and also for the indicated volume for the budget period. Facilities have to be planned for normal volume. Profit and loss figures should be predicated both on normal and index volume so that information is available to judge the economics of the business as well as the probable financial results for the budget period.

The sales figures are the heart of the budget and are too important to be left to guesses such as past performance or someone's optimistic or pessimistic estimates. Sales forecasts should be predicated upon accurate market analyses based on the wealth of general and specific data available. The market analysis should, of course, be tempered by the experience and sound judgment of the sales manager. The sales forecasts should also be subject to check by the accounting organization.

It is helpful if the sales volume budget is prepared in detail by customers or customer type, territory, model or part number, and selling price. It is also advisable to indicate delivery requirements so that inventories may be planned and production properly programmed.

On the basis of the sales forecast a production schedule is established, taking into consideration the inventory position at the start of the budget period and the desired inventory position at the end of the budget period. Consideration is given also to stabilization of employment and maximum use of facilities by leveling out production peaks and valleys. We are then in a position to establish

budgets and compute the elements of factory costs, consisting of the three principal classifications; namely, productive material, productive labor, and manufacturing expense.

Productive Material and Labor

The budget for productive material should be predicated upon the quantitative standards of the type of material specified for each piece part number, extended by the estimated unit purchase price. The quantitative requirements should be available from the material standards furnished by the manufacturing engineering department. In establishing material yield it is important that realistic rather than theoretical standards be set. For example, the engineering department may have to allow for a percentage of random lengths. Obviously, allowances must be made for such conditions to avoid the establishment of a "bogey" rather than an efficient and attainable working standard.

To calculate the material cost, the unit purchase price used in the budget should represent the current market. No attempt should be made to speculate on probable or possible price changes.

The budget for productive labor should represent labor time standards or estimates extended at current labor rates. The time standards are usually established by the time study or industrial engineering department. For budget purposes allowances should be provided for normal variances so that the time standards used will represent normal and efficient operations rather than unattainable ideals. Also, labor rates should be the established job rates at the time the budget is prepared, with allowances for merit and automatic rate increases provided for in the wage rate structure, but there should be no provisions for possible future general wage rate increases.

Manufacturing Expense

The toughest part of the budget is the establishment of proper manufacturing expense standards, because it is necessary to deal with a multitude of items and several factors. Whereas productive material and productive labor vary in direct relation to volume, manufacturing expense includes elements which are fixed, partly fixed and partly variable, and elements which are directly variable with production. We could, of course, get into a nice academic discussion as to when an item should be considered fixed, or if there is such a thing as fixed expense, or how to treat an item

which is partly fixed and partly variable. In this paper we are going to dispose of the problem very simply by classifying expense into two elements; namely, fixed and variable. Fixed expense will represent specified items which will be incurred at minimum volume or even on a shutdown basis, as a matter of policy. All other expense will be considered variable.

Since manufacturing expense is composed of hundreds of different items and elements it is necessary to subdivide the aggregate into a reasonable number of logical groupings to facilitate management control. We have found in our organization that nine major expense groups cover all our main expense classifications and at the same time are not so great a number as to make budget reports cumbersome. The nine major groups we use are:

1. Indirect salaries and wages.
2. Operating supplies.
3. Expense tools.
4. Power and utilities.
5. Maintenance and rearrangements.
6. Employees' insurance and taxes, etc.
7. Losses, errors, and defects.
8. Fixed charges.
9. Sundry.

We have established the foregoing nine major groups for budget reporting purposes with provisions in our accounting for subgroups and detailed accounts within each major group to facilitate further analyses which are required from time to time.

Establishing Fixed Expense Budgets

In effect, a manufacturing expense budget is a consolidation of two separate budgets, that is, a budget for fixed expense and a variable expense budget. Usually the fixed standards include the salaries and wages of supervisory and key personnel who would be retained during a prolonged period of low-volume operations or during temporary shutdown conditions, the cost of fuel for heating, power demand charges, minimum maintenance to preserve buildings and equipment from deterioration, employees' insurance and tax expense of personnel who are classified as fixed, depreciation, property insurance, property taxes, rentals, minimum telephone charges, and similar items. It is good practice to set up

the fixed budget in detailed schedule form so that it may be readily reviewed and passed upon by management. After approval the fixed allowances are expressed as a specified sum per month for each major group of expense.

Determination of Variable Expense Budget

Variable expense is that portion of expense which will vary or, rather, which will be controlled in relationship to production volume. In our own organization we express variable expense rates as a percentage of standard productive labor. It is important to note that standard productive labor is a stable measuring stick and is representative of physical output. For example, if in our profit and loss budget we allow $1 as standard productive labor for part "A", that allowance remains constant for the entire budget year. If the variable expense rate is 200 per cent of standard productive labor the plant will be given a budget allowance of $2 for variable expense for each unit of part "A" which is produced, regardless of whether the actual labor cost of part "A" is 85 cents or $1.15. By this technique we are able to measure properly the variations from our profit and loss budget in both productive labor costs and variable expense in relationship to the physical output of our plant.

Our basis for establishing the variable expense budget rates is a study of satisfactory past performance with proper adjustments for nonrecurring items and with allowances for new or changed conditions. This study is supplemented by engineering analyses of all expense factors, such as salaried and hourly nonproductive forces, tools, supplies, maintenance, rejects, and scrap.

Commercial Expense

After we have completed the budgets for manufacturing costs we have to provide for and control the so-called commercial expense accounts. These include selling, advertising, administration, loading and shipping, etc. In some companies these accounts represent a sizable portion of the total outlay. It is important that these accounts be controlled as effectively as manufacturing cost because they are equally a part of the sales dollar outlay. Contrary to the belief on the part of some executives, these expenses are not fixed. They contain both variable and fixed elements and it is just as important to analyze these expenses into the basic elements as it is for manufacturing expense.

In our own organization we express the variable rate for commercial expense as a percentage of sales. We apply our budget factors against revised sales forecasts at least once each quarter to determine what our outlay should be. The control of commercial expense is a good deal easier to exercise than the control of manufacturing expense. It is recognized that there may be special circumstances which require abnormal expenditures at a particular time, such as a sales drive, the introduction of a new product, or a special advertising campaign. This may mean that the budget will be temporarily exceeded. But it does not mean that budgeting has no application to commercial expense.

The Final Result

The completed profit and loss budget will indicate the profit on sales, return on investment, variable or economic profit, and the break-even volume. On the basis of the factors developed, information is available for projecting profit or loss and invested capital at any sales volume within a reasonable range. If management is satisfied with the result, the profit and loss budget becomes the operating objective. If not, further reviews and studies are necessary. There may or may not be the possibility of changing sales prices. Usually there is not, unless the changes are downward. Ordinarily, if the result is unsatisfactory, it means the trimming of costs and investment.

Material Cost Control

The engineering standards for each part produced extended at the unit prices determine the budget for productive materials. A check of the primary operations is made to guarantee that usage standards are realized. The yield is matched with the material requisitioned and if less than the standard quantity is produced a shortage ticket is prepared, while if more than the standard yield is obtained an overage ticket is made out. These shortages or overages represent losses or savings respectively.

Savings or losses may result from material substitutions. In all instances of substitutions the standard material size and specification as well as the actual size and specification are stated on the material requisition so that variances may be readily determined.

The third kind of variance is the purchase price difference. This is computed each month by matching the price paid as invoiced by

vendors against the standard unit purchase prices provided for in the budget.

Labor Cost Control

The budget for productive labor is controlled by measuring the standard labor cost provided in our profit and loss budget study against the actual labor cost for each part produced by department. This necessitates the double pricing of each productive labor ticket so that actual and standard labor may be computed. As previously stated, the standard labor is used as the basis for determining variable expense budgets and since standard labor remains constant for the budget year, expense allowances under this procedure are related to physical units of production. In our organization we analyze productive labor variances into five major classifications which are:

1. Low efficiencies of productive operators.
2. Use of less efficient equipment or tooling.
3. Less than full complement of machines.
4. Touch-up operations.
5. Substituted material.

Manufacturing Expense Control

The base upon which manufacturing expense standards are computed is obtained by resolving units produced into standard productive labor (allowed labor in the profit and loss budget). Next, standard productive labor is extended by the standard variable expense rates to determine standard variable expense which, when added to the fixed expense allowance, equals the total budget for manufacturing expense. This computation is made for each productive department and each nonproductive or service budget division of the plant.

The allowance for each productive department is based on the output of the particular department as expressed in terms of standard productive labor. The budget allowance for general service departments is calculated on the total standard productive labor of the plant as a whole.

Content of Daily Plant Report

It is one thing to have a sound procedure for establishing budgets; but unless management receives current reports of budget

performance the budget falls short of being a valuable operating tool. Recognizing the importance of reports that are news rather than history, we prepare a daily plant report. This report is issued by 3:00 p.m. each day, showing the actual and budgeted expense for each of the nine main groups, savings or losses by the nine major groups, and savings or losses in productive labor for the month to date.

The form itself is simple and contains few, but highly significant, figures. It shows in columnar form the following information for each of the nine classes of manufacturing expenses:

1. Expense for the day.
2. Fixed expense allowance for the day.
3. Actual variable expense for the day (item 1 minus item 2).
4. Standard variable expense for the day (standard productive labor for the day multiplied by standard variable expense rates).
5. Savings or losses on variable expense (item 3 minus item 4).
6. Accumulated savings or losses in variable expenses for month to date.
7. Actual variable expense rate.
8. Standard variable expense rate.

The information described above takes up approximately two-thirds of the upper part of the form. In the bottom part of the form is shown the actual productive labor, standard productive labor, savings in productive labor, savings in burden (which is taken from the upper half of the form), and total savings in productive labor and manufacturing expense. All this information is shown for both the day reported and for the month to date. We also indicate to the right of the bottom part of the report the overtime premiums incurred for both the day and month to date. This is highly significant information which the management will want to watch because it may be necessary to take corrective action if excessive expenditures are being made for overtime premiums.

Organization for Daily Plant Report

Persons not familiar with the preparation of daily reports might wonder how the accounting organization can be equipped to issue such information on a daily basis without a considerable increase in the clerical forces. Our experience over ten years is that the

necessity of keeping up to date on a daily basis has resulted in a more efficient accounting organization, has speeded up the process of rendering all reports, including the financial report, and all this without increasing clerical cost.

To prepare this daily information it is necessary to gear the accounting organization to do the job. Daily production tickets are rated to get actual and standard productive labor. Nonproductive labor tickets are tabulated daily, as are material requisitions and scrap tickets. Accounts payable vouchers chargeable to expense are summarized daily. Some expenses are calculated a month in advance and prorated on a daily basis. Examples of these are salary payroll, depreciation, insurance, taxes, power, and also larger purchases of services and materials. Our experience in accomplishing this work on a daily basis has been that the accounting organization is "toned up" and keeps its work current, thereby minimizing month-end "peaks".

On the first day of each month we give our management a report marked "preliminary," which shows the performance in manufacturing expense and productive labor for the previous month. On the tenth of the month, when our books are closed, we issue a final report. It has been our experience that the difference between the preliminary and final report is usually less than one per cent.

Departmental Budget Statements

We issue departmental budget reports every ten days, using the same form and showing the same information as we do on the daily plant report just discussed. We feel that the operating departments are so close to their budget figures that a more frequent reporting is not necessary. Furthermore, any really bad conditions are reflected on the over-all plant report and may be traced back to the responsible department.

Budget Performance Forecast

To do a good cost control job it is necessary to plan in advance. Budget reports, after all, are after the fact, no matter if they are issued a day or a week after the close of the period. Realizing this, some years ago we instituted a "forecast of budget performance" procedure. Briefly, the procedure works something like this. Each productive department, along with its production schedule, is given the computation of standard productive labor. The nonproductive departments are given the total for the plant.

Between the 20th and 25th of each month each department foreman or supervisor, with the help of a representative of the budget department, prepares an expense forecast for the following month. The budget department makes available data on forces and other expense items, and also current and past performance information to serve as a guide.

The expense forecasts are compared with the budget allowances based on the production scheduled. Anticipated overruns are fully explained. The departmental forecasts are reviewed with the divisional superintendent. Divisional forecasts and the over-all plant forecasts are reviewed with plant management and upon approval become the authorization for expenditures for the following month. We consider this monthly forecast of budget performance our most effective cost control tool because it necessitates a good planning job on the part of each department and it provides management with a forward, "before the fact" picture.

Foreman Assistance Reports

We try to avoid encumbering the foreman and operating supervision with statements and reports. Our management's philosophy is that the foreman should do a minimum amount of paper work and concentrate on the physical job to be done. However, there are some vital figures that a foreman must have to do a good cost job, and we try to limit the information we give him to essentials. Some of the foreman assistance reports and information we issue are as follows:

1. Daily report of outstanding scrap items, showing quantity, part number, and value.
2. Weekly report of rejects as a percentage of acceptable production.
3. Weekly reports showing individual productive workers earning less than 100 per cent efficiency; also, actual hours worked, standard hours earned, and the cost of low efficiency.
4. Weekly reports of departmental labor effectiveness, i.e., actual hours on production plus hours charged to product rework and downtime compared with standard hours produced. The purpose of this report is to show labor and machine investment ineffectively utilized.

5. Weekly analysis of productive workers' hours charged to nonproductive activities.
6. Weekly report of productive labor variances by cause and amount.

Physical Unit Budgets

With the effectively developed budget plans and procedures, already described, the attainment of the budget objective may be implemented by the use of physical unit budgets. Physical unit budgets would not supplant procedures such as we have already discussed but would supplement such procedures. As was pointed out earlier, the most accurate method of establishing expense standards is the engineering approach, such as is commonly used to establish standards for direct labor and direct material. Such an approach used for manufacturing expense standards would establish budgets on the basis of the people and things required to produce a predetermined work schedule. Examples of this kind of an approach are:

1. The number of productive workers required, by occupation, would be computed by extending the production schedule by the direct labor standards.
2. Manpower requirements of indirect or service personnel would also be calculated from the physical standards established for the different occupations or employee classifications involved. As an illustration, there are a number of occupations required to service productive workers directly. Typical of these are group leaders, laborers, inspectors, tool crib attendants, time checkers, etc. The standards for these would be expressed in relation to the number of productive operators serviced. Sweepers, janitors, and plant protection classifications may be related to the area serviced. Setup operators would be determined on the number and kinds of scheduled setups.
3. Physical budget standards may also be established for indirect material and tool items based on the various factors which determine the use of the different items involved. For example, the standards for the various kinds of lubricants and cutting compounds would be predicated on the scheduled machine hours; towels, gloves, safety shoes, as allowances per employee; cleaning compound,

brooms, brushes, as allowances per square foot of floor space; cutting tools on the basis of number of pieces to be machined.

Budget reports in financial terms are too involved for foremen and supervisors to follow. The foreman does not have the aptitude for accounting figures nor the time to spend on them. Besides, the accountant with all his training and with the facilities at his disposal, requires a period of time, however short, to accumulate actual and budgeted expense. Therefore, under usual budget procedures the foreman does not know how he is performing until after the fact. Furthermore, financial budget variances may be the result of both price and yield variances. For example, a budget loss may be the result of a wage increase or a price increase as well as excessive forces or excessive usage of materials, or sometimes it may be a combination of both.

Purpose of Physical Budgets

Physical unit budgets make it possible to give a foreman a "bill of material" of the people and things required to accomplish a production schedule. With such standards available it is not only possible to calculate productive workers required, but also nonproductive manpower requirements in terms of personnel, by occupations, as well as the physical quantities of indirect materials and tools required.

With a "bill of material" available, the foreman or supervisor needs only to "count noses" to determine if he is meeting his budget as far as personnel is concerned. He may also check off the indirect materials and tools he has requisitioned against a list. He then knows that if he keeps within his "bill of material" and if he produces his manufacturing schedule his costs will be in line.

It is the accountant's job to reconcile the physical units budget and the financial budget. In other words, if operating supervision meets the physical budget standards, but there is a financial budget variance due to rate differences, price variations, specification changes, etc., the budget department should give management the explanation rather than burdening operating supervision.

One note of caution with regard to physical unit budgets. Do not try to cover every nut, bolt, screw, or other inconsequential item. Concentrate on the key items, the major elements that ac-

count for 80 to 95 per cent of the expenditures. If these are in line the total budget will also be met or bettered.[1]

Conclusion

With the virtual commitment on the part of industry to attain high level, continuous employment with high wages and reasonable prices, industry faces many new and imposing problems. The days of high unit profit margins are over. Reasonable profits and returns on investment must be realized from high volume, low unit cost, narrow unit profit margins, and high turnover of investment. New heights of productivity will have to be reached in order that a company may grow and prosper, higher productivity in all phases of the organization, the maximum output from a reasonable input of physical effort, the elimination of waste in all forms, in short, the greatest production yield from a given quantity of manpower, materials, tools, equipment, and working capital.

For a business to cope with conditions that lie ahead, it will be necessary to have sound planning and adequate budgeting procedures. Intelligent cost control will be a requisite. Management will rely more than ever on the cost accountant for assistance in steering the difficult course ahead. To the cost accountant, it means a greater responsibility, but along with that responsibility is the opportunity of demonstrating as never before that he is an indispensable part of management.

[1] For further details on physical unit budgets, see "Controlling Costs With Physical Unit Budgets" by the same author in the N. A. C. A. Year Book, 1944, pp. 143-169.

STANDARD COSTS IN CANADA

There has always been a good deal of discussion for and against the use of standard costs. Their application in this industry shows, in my opinion, an objective analysis of the situation that is commendable. They have been in operation a number of years and have proved their worth. . . . A good percentage of the work done in this plant is obviously of a standardized nature and standard costs are quite easily applied. We have found, however, that not a great deal more trouble was needed to apply standards to more complicated and intricate types of work. On the cost of costing side of the picture there is, of course, an extremely potent argument. All the way through the costing picture from the pricing of stores at standard prices to preparation of reports, there is, by using standard costs, a distinct saving in the expense of the cost department.—*N. R. Barfoot, in describing the cost system of the Galt Metal Industries, Ltd., in* Cost and Management *for September, 1946.*

THE INDUSTRIAL ENGINEER, THE COST ACCOUNTANT, AND LABOR STANDARDS

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STANDARD cost procedure is recommended as the most logical means for obtaining control of factory costs, because it provides an analytical statement of operations and establishes a sound basis for intelligent action. It is therefore essential that the complete procedure be reviewed periodically. It is particularly important at this time as we enter a period of national economy that may prove entirely foreign to the experience of the last four years. During the war years conditions did not generally permit proper maintenance of this control medium. Possibly this was not required. The emphasis seems to have been placed largely on recording how much the cost has been, rather than on determining what it should have been. The review of the data and a re-establishment of cost standards must be placed on a specified or standard approach. While every department of a business has its cost problems, the real problem of cost control is in the factory. I believe that the competitive situation anticipated will further emphasize this assertion. It is here that the business executive, anxious to check his rising costs, can attack his problems to the best advantage. Labor is an important part of factory cost, since cost is dependent, to a considerable degree, upon worker productivity. The productivity of the worker depends largely on the presence or absence of a spirit of cooperation in his work. Cooperative worker attitudes are induced by correct management policies in dealing with employees. Therefore, through the use of standards management has a logical medium for the factual determination of procedures which will permit those responsible for the personnel of business to do an economical human engineering job.

One of the advantages of standards is the great saving in executive time due to the application of the principle of exceptions, that is, actual results or activities that fail to come up to standard performance receive major attention. This makes it imperative that the standards set take into consideration everything possible affecting performance and that they be sound criteria of what ought to be done; otherwise, unhealthy conditions will be ignored. Good standards should be sufficiently hard of attainment to compel the

maximum performance of which the operating divisions are capable; at the same time they must be sufficiently fair and possible of attainment to encourage rather than discourage these divisions in their efforts toward better achievements.

With these thoughts in mind it is possible to outline the parts the industrial engineer and the cost accountant should play in the development of labor cost control methods through the medium of standards.

Preliminary studies affecting materials, machinery, equipment, and the workplace must first be made before proceeding with the actual determination of the physical standards for costs. The investigational problems involved are the work of the industrial engineer, whose function it is also, by reason of his training and contact with operating departments, to set standards for labor.

Standard Time Units

In the development of labor standards, two prime factors are involved, namely:

1. Standard time units.
2. Standard hourly rates.

The first and most important step in determining a standard labor cost is to determine the standard time required to perform the operation in making the article. Since labor rates are subject to change, it is impossible to start with any labor cost which ignores time and arrive at a basically adequate standard. The standard time unit or the time required under normally efficient operation to process a unit of the product is part of the work of the industrial engineer and is derived after making a time study and in some cases a motion study. The chief value of motion and time studies lies in the standardization of conditions and methods, the former representing the material things surrounding the operation and the latter the motions executed by the worker in performing the operation. Conditions and method in actual practice are inseparable. Almost every change of condition requires a change of method and many changes of method require changed conditions.

Independent time studies without method studies have no permanent value. A standard established on the basis of such a time study alone tends to become antiquated sooner, whether used as a basis of wage payment or for labor cost standards. This is so because of the improvements which are automatically made by the

production organization, particularly if a wage incentive provides the motive. Time study which has not effected any improvements in methods nor eliminated any waste of time or of labor will soon make the standard obsolete because of improvements in methods that normally occur. The method study is necessary for two reasons; first, to bring the standard costs down to a reasonably low level and, second, to insure a standard which is not only correct at the moment but which will remain so until some fundamental change has been made in the operating practice.

Over-all and Unit Time Studies

The most common way of approaching and doing a time study is from the viewpoint of the time required to perform all operations in making a definite part, subassembly, or assembly. This is known as an over-all time study. The other way is the time required to perform definite elemental operations, processes, etc., termed a unit time study. Once standard times are determined, recorded, charted, or reduced to formulas, a standard time per piece can be determined mathematically.

Unit time study is more useful and in the long run more economical than over-all time study. An over-all time is useful only for the operation studied and becomes worthless when the operation is changed in any part. It does not permit refinement of standardization through comparison of the unit times of various operations and it does not serve to define and improve method. Unit times, on the other hand, permit comparison with respect to a given operation of various operators, and the discovery of a "best way" with respect to each unit. They permit comparison of one operation with another. If properly classified and filed, a large portion of them may be repeatedly used in building up total times for an operation which is changed in some detail, or for new operations which have coincident units. Unit time study defines and improves methods, since it captures the methods of the best workers, and so perpetuates and makes them available to all workers.

Time Study Allowances

In using time study as a basis for the determination of standard piece rates there are certain allowances that must first be computed and added to the standard operating time. In practice, allowances are generally determined to cover losses due to fatigue, recurring interruptions, and for time required to set up and strip machines

and to change tools. The inclusion of allowances insures the fairness of the standard task time and should enable the worker of average ability to meet or better the task requirements. Allowances are made in recognition of the fact that the operator cannot be expected to work continuously at the machine or bench at a maximum speed, especially if the work is of an arduous character.

The exact determination of the fatigue allowances is a difficult matter, being influenced by the character of the work and the physical characteristics of the individual worker. Machine operations are in general less productive of fatigue than manual operations. For the former the allowances will vary depending upon the degree of continuity of attendance. On work requiring tools and operations of similar character it is often possible to classify the work and set fatigue allowances for each type of operation. Such allowances are usually figured as a percentage of the operating allowance, and added to it in the setting of standard task time.

Allowances for setting up and stripping machines and for setting tools are of a more definite character, and their determination should be included as part of the time study. The amount of allowance will, of course, depend upon the character of equipment and operation. In plants where there are many operations of similar character, allowances for setup, tooling, etc., may be determined from a special study, and the data classified according to machine or types of operations. Standard allowances for setting up and stripping machines are not included as part of the standard task allowance but are treated independently. The degree of importance to be attached to these allowances will depend upon the frequency of their occurrence and the relative amount of time they consume.

From the foregoing it may be inferred that when standards are based upon thorough and complete motion and time studies they have a certain permanent characteristic. The impression is not conveyed, however, that any standard should ever become an intrinsic attribute of an operation or part. No standard should be conceived as ultimate; rather it should be considered as being in a progressive state of improvement, undergoing constant revision as rapidly as improved processes and more effective methods can be adopted.

Operation Sheets

Standards will not remain standard very long unless written instructions are drawn up covering every factor in detail. There

should be an operation sheet for each article or part produced, showing the operations, the department, and the machine performing them. The rated production per hour and the piecework rate may be added also. Operation sheets may be supplemented by blue prints or drawings.

The written instructions should be of two sorts, general and detailed. General instructions should include such points as the capacity of the machine, speeds at which the machine is to be run under varying conditions, equipment necessary, relation of the work of a particular employee to that of some other employee, placing the equipment in a convenient place, or the storing of the machine parts in proper racks.

Detailed instructions should cover the exact method of operation. It is evident that when a definite, carefully planned method has been worked out on which the standard times are based, the employee should use this method. Moreover, should the workman fail to perform the operation within the standard time, he should be further instructed in the standard method and thereafter be required to follow it. These instructions are also of value to the management since they describe the method in use when the standard times are set.

Another advantage of operation sheets is that they tend to prevent the insertion of extra operations; if extra operations are performed the cost accountant has the opportunity of showing them in a labor variance or in any other manner he sees fit. If operations are performed by hand machines when they should be performed by automatic machines, or if they are performed by men when they should be performed by women, he is in a position to show the extra cost of such departure from standard.

Application of Standards

The standard which has been determined as correct is often different from the one by which the employees have been doing the work. In such cases it is necessary to have the instructor demonstrate to them the best way. In operations where no big change has been made, the necessity of having someone on hand when an employee starts working on the new rates is not so evident. Years of experience, however, have shown that such a precaution is desirable. Ordinarily, even on piecework the amount done by various employees varies considerably due to the use of different methods, uneven supply of materials, loafing, lack of ability, lack

of interest, and lack of belief in the management's good faith. Job standardization can reduce the irregularities in production by attacking the causes and by starting the standards properly. Planning work ahead provides a comparative uniform flow of work. The other causes are more psychological in nature and resolve themselves into individual manifestations. It is, therefore, better to work with the employees as individuals, starting them one by one, instructing them in standard methods, and convincing them that the standards are just.

Standard Hourly Rates and Job Description

Just as important as the physical standards set by the methods or industrial engineer, are the factors and elements used in the scientific pricing of standards for hourly rates. To determine what should be paid to labor requires a scientific approach to the problem through job analysis. The latter means getting the facts, securing opinion, and recording these facts and opinions in some standardized form, called a job description or job specification. Factual matters include the duties assigned to individuals, the limits of their responsibility and authority in connection with each duty, the conditions under which they work, and their working hours. Matters of opinion deal largely with the qualifications which the individual needs in order to learn and to do the work satisfactorily.

The information for the job description can be secured in either one of two ways: by actual interview or by the questionnaire method. Where hourly rated jobs are being studied the use of questionnaires is impractical because the majority of employees are not able to describe their work satisfactorily. Although the responsibility and authority for carrying through a complete program of wage and salary administration is usually assigned to the industrial relations or personnel department, the industrial engineer is sometimes called upon to aid in making the job analysis.

The job description is the written record of the duties, responsibilities, and requirements of a particular job and is the starting point for ascertaining base rates. It is an aid to the personnel department in selecting and placing employees and a source of considerable information to the supervisory force. These factors play an important part in labor control, especially in connection with labor turnover. Furthermore, the success of any job evaluation plan depends upon the confidence that the workers and supervisors

have in that plan. The information contained in the job description forms the nucleus for properly rating jobs and paying the worker according to his relative worth. Therefore, before proceeding with any plan of job evaluation it is necessary for the information on the job description to have the full approval and complete understanding of the supervisory force and the workers themselves.

Job Evaluation

The primary objective of job evaluation is the study of the relative requirements of jobs for the purpose of establishing rates for those jobs that satisfactorily reward the worker for the work performed. The relative requirements of the job are determined by job analysis. In using the job description as the basis for the job evaluation there are two methods of analysis used; namely, the ranking and point rating methods. Both methods consider job elements. In the ranking method jobs are compared against jobs; in the point method jobs are compared against some scale. I prefer the point method. However, each method adheres to the following procedure for its application:

1. Detailed written descriptions of all important duties and responsibilities of each individual position.
2. Selection of factors which are common to all jobs.
3. Determination of relative importance or weight of these factors.
4. Assignment of point values to each factor for convenience in rating.
5. Analyzing each job to determine the relative degree to which the factors selected are present in the job, and assigning point values or ratings to these factors.
6. Classifying jobs into groups containing the same range of rating points.
7. Converting the points into dollar amounts.

It is not the purpose of this paper to discuss the relative merits of various plans of job evaluation. The important point is that a scientific study and analysis have been given to the problem of determining how much a job is worth relative to the other jobs within the factory.

After the plan of organization has been carefully studied and worked out, standards established, routines developed, and the business placed in condition to function in a most effective manner, it has usually been assumed that it will do so without further attention. Experience has shown that this is not so. Unless the plan of organization and the mechanisms which were developed in connection with it are constantly examined and inspected, members of the organization and the whole process will gradually revert to the old methods.

Maintenance of Standards

A standard is neither established nor maintained by the simple process of publishing the specifications which define it. The mere entry of a predetermined time graphically does not insure getting the work out on time. For instance, if precalculated times are wrong the whole schedule may be upset. And even if predetermined times are correct, orders, instructions, tools, and materials must be issued to machine operators at exactly the right times or schedules may not even be approached. In other words, it is obviously useless to set up job standards and standard practices based on certain definite machine performance and physical arrangements in the plant unless definite steps are taken to assure performance. That is the function of maintenance.

This subject is such a broad one that it will not be possible to go into a detailed and exhaustive discussion of the maintenance of standards. It is proposed, however, to discuss the subject under three divisions: (1) planning, routing, and scheduling the work; (2) development of procedure for systematic inspection of conditions and performance; and (3) providing the incentive to achieve.

Planning, Routing, and Scheduling the Work

Production control is a necessary adjunct to labor cost control. It provides for efficient use of the mechanical equipment, for the proper amount of stock on hand in the form of manufactured and purchased parts, for a sufficient but not too large supply of raw materials, and for cooperation with the proper authorities as to specifications, standards, sequence of operations, and many other matters. The following is an outline of the steps necessary for planned control:

I. How shall the work be done? (Routing)

A. Order analysis.

1. Order translated into terms of parts and materials.

a. Parts needed.

(1) Stocked as subassemblies.

(a) Manufactured and/or purchased parts.

(2) Single manufactured or purchased parts.

2. Parts required checked with stock in stock room and a schedule made out of parts which must be purchased or manufactured.

a. Promise of delivery made to sales department on this basis.

3. Determination of economical lot sizes.

B. Relation of work order to standard instructions.

1. Instruction sheet.

a. Type of machine.

(1) Best one on which to do the work.

(2) Next best one on which to do the work.

b. Tools and fixtures required to do the job (tool list).

c. Detailed list of operations. Order of operations sequence.

(1) Setup details where machine operations are concerned.

(2) Standard time to perform operations.

d. Drawings and blueprints.

2. Work order.

a. Covers a specific number of parts.

b. Production order number assigned.

c. Specific data when each operation should be:

(1) Started.

(2) Finished.

II. Where shall the work be done? (Scheduling)

A. Importance of orders.

1. Master schedule indicating relative importance of orders.

B. Is the job ready to be begun?

1. Is there enough material on hand to complete the order?
2. Is the machine in a position to handle the order?
3. Do we have the tools to work the job and are they in good condition?

C. Scheduling the work.

1. Allocation of work to machines or nonmachine operators.
2. Use of charts or schedules to enable the production control function to tell at a glance exactly what the manufacturing people have ahead of them.

a. Necessary to maintain sequence and dates for the various operations.

III. When shall the work be done? (Dispatching)

A. Preparation of work order (Instructions to a definite man to perform a definite operation on a definite piece or lot by the use of a definite machine. It is customary to issue to the operator a time ticket and work order at the same time. Time tickets indicate the order to be worked upon and the machine on which the job is to be done. By putting the worker's name or number or both on the time ticket, the employee is definitely sent to a particular task. (Serves also as a basis for making up payroll).

B. Dispatching: System of orders by which work is dispatched.

1. Equipment and tools.
    a. Instructions to set up machine and the tools necessary to do the job.
2. Material issues. Indicate the machine or group of machines to which the material should be delivered. This serves as an order for the transportation of material to the first operation as well as a demand for its use.
3. Move tickets. Order to move or transport material from one workplace to another.
4. Workers.
    a. Use of work orders and time tickets.
5. Control of inspection.
    a. First and final inspection.
        (1) Use of inspection tickets to dispatch inspector to the job.

C. Use of dispatch boards or subdispatch boards.

1. Control whereby foremen and production control manager keep in complete and continuous touch with all operations under their supervision, thus enabling them to make any adjustments which they consider necessary.
    a. Use of graphic methods to watch progress of work.

Systematic Inspection of Conditions and Performance

Economical equipment maintenance implies the application of preventive measures and can be achieved only by carefully planned inspection. Such inspection should be minutely scheduled according to the degree of control desired and a tickler file must be provided to be certain that the established schedule is maintained. A brief outline of the procedure which I feel is essential is given below:

I. Maintenance of standards for plant and equipment.

A. Fundamental requirements.

1. Standards must be established for every piece of machinery and equipment and every machine should be placed in this standard condition.

2. A careful study should be made of the machinery and equipment in order to develop a schedule which will indicate the frequency of necessary inspections of the various parts to be inspected.

    a. Possibility of failure of all parts is not equal. Some parts may require daily inspection, whereas for others monthly inspection may be adequate.

3. After the schedule of inspection has been developed a tickler file should be established which will automatically bring forth those items which are to be inspected on a particular day.

4. Method of inspection should be carefully defined.

    a. Inspectors should be told definitely the parts to be inspected and instructed in the method to be followed.

5. Should a failure of a machine or a piece of equipment occur in spite of regular inspections, a careful investigation of the cause should be made to determine why the failure was not anticipated by the inspector and thus prevented.

    a. Result of this investigation may necessitate a revision of the inspection schedule.

II. Maintenance of tool standards.

A. Tool inspections.

1. No tool to be returned to its storage place in the tool room unless it is first inspected.

2. New tools purchased should be inspected to determine whether or not they meet the established standards.

    a. Tools are standardized by agreement between the time study and instruction card men.

B. Tool repair.

1. Tools which cannot pass inspection should be repaired so that they will meet definitely established standards before they are returned to their place in the toolroom.

2. Tool repair department is usually operated in connection with the toolroom.

a. Tool repair should not be left to workers in the shop.

C. Proper storage and control of tools.

1. In order to supply the proper standard tools to the shop when required, it is necessary that the tools be properly classified and stored in the toolroom.

Providing the Incentive to Achieve

Unless management is working toward a goal of accomplishment there is no incentive present for the efficient utilization of labor. Naturally, too, the supervisor or foreman who is charged with the responsibility for the efficient use of his workers' time will want to know in understandable terms what steps he must take under varying conditions, if he is to keep in line with what ought to be spent for labor. This calls for the use of a budget of operation under varying volumes of production, in other words, a flexible budget. To the foreman, physical units such as the number of workers and number of man-hours are more interesting and informative than dollars of cost.

The make-up of the labor budget calls for cooperative effort on the part of both the industrial engineer and the cost accountant. The industrial engineer understands the problems facing the foreman because it is he who has helped the foreman to understand the time study, the importance of planning his work, the control of waste, the need for cost control, etc. The industrial engineer talks the foreman's language; he knows how to break down the many activities that go into a manufacturing process in terms the foreman understands. Therefore, the industrial engineer can be of great help to the cost accountant in drawing up the budget for the effective utilization of labor.

It is the cost accountant's function to measure experience against goals of accomplishment. The causes for variation are generally

problems of correction for the industrial engineer. To the industrial engineer, the story behind the figures is more important than the figures themselves. A cooperative analysis on the part of the industrial engineer and the cost accountant of the detail supporting the budget variances, will aid considerably in determining the corrective measures to be applied.

Wage Incentives

After labor standards have been scientifically determined it is necessary to provide the worker with the proper motive for accomplishment. The answer lies in monetary recognition for achievement in the form of an incentive. The plan to use should be based on the principle of average response. In other words, the incentive that will hold the maximum number of employees involved near the maximum production of which they are capable is the ideal plan to use. From an accounting viewpoint, an incentive plan which succeeds in holding the average production response at a higher efficiency than another incentive plan distributes the fixed overhead over more units, and thus reduces the overhead per unit.

Naturally, any incentive plan to be successful must be understood by the worker. Also, it must be of such design that it can become an integral part of other management controls. Since incentives are directly related to standards, they come within the province which the cost accountant shares with the industrial engineer. And, since incentives are a form of management control, both the cost accountant and the industrial engineer should sit with management when consideration is given to the adoption of a wage incentive system.

Merit Rating

Merit rating is a practical device to recognize employee service to his company, to recognize extra skill or judgment which results in more or better product per hour, and to recognize dependability, loyalty, ability to assume responsibility, ability to instruct, etc. Under an incentive plan much of this may be attained automatically, but even so it is common to figure incentive wages in terms of standard hours through which the hourly rate can vary according to individuals.

Merit rating places a value on the above mentioned assets in terms of individual differentials so that they reflect actual worth.

Therefore, it gives satisfaction to the worker in the form of increased earnings for a job well done. To management, it is an effective form of labor control, because it has for its primary purpose the raising of the standards of performance of the working force. Through the medium of merit rating the employee is rated at stated periods on such factors as: (1) quantity of work, (2) quality of work, (3) adaptability, (4) job knowledge, (5) dependability, (6) attitude. The management knows from this personnel report what type of worker it has in Tom Jones, why he did or did not receive a raise or promotion during this rating period, whether he needs further training to correct a deficiency, and whether he should be changed to another job. Because he is rated periodically the worker knows that his work record is receiving management's consideration. He wants to do better than standard so that he may earn the highest rate in the range for that job.

While it is true that merit rating is usually a function of the personnel department, it is not unusual to find the personnel problems requiring for their solution the combined efforts of the foreman, the personnel department, and the industrial engineer.

Variances From Standard

A knowledge of the location and the causes for variation from standard cost is essential to effective placement of the responsibility for the results obtained. The accumulation of actual costs in comparison with the standards to indicate causes for the labor variations is part of the work of the cost accountant. This in turn depends upon an effective account classification which serves to sort and high-light business relationships in proper perspective and relative emphasis. It is not within the scope of this paper to indicate a method to be used in recording cost variations. It is more significant to indicate causes for labor variations under two broad classifications; namely, variations from the standard labor time and variations from the standard labor rate, as follows:

A. Variations from standard labor time may be incurred by

1. Working with inferior or defective material.
2. Failure to use the methods, layouts, and machines specified as the standard means of manufacturing in the plant.

3. Poor adjustment of the machine prior to an operation.
4. Improper tools for the job.
5. Failure to produce output in economical quantities.
6. Failure to produce standard output due to breakdowns either in the flow of production or the supply of facilities.
7. Failure to produce standard output due neither to causes within the control of the operators nor to any breakdown in the flow of production or the supply of facilities.
    a. Inadequate or incorrect training for the job.
        (1) Operators, due to the absence of workers, may be shifted to unfamiliar jobs.
        (2) Operators may have advanced to another grade of job.
        (3) Operators may have been transferred from another department.
    b. Operators may be learning to use an unfamiliar machine.
8. Poor time studies.
9. Unsatisfactory working conditions.

B. Variations from the standard labor rates may be caused by

1. New operators assigned to the job.
2. Poor selection of workers.
3. Use of the wrong class of labor.
4. Guaranteed base rates.
5. Increase in wages.
    a. General economic causes, such as the increased cost of living, increase in the going rate of wages, or shortage of labor.
    b. Annual wage increase policy.
    c. Poor wage or incentive plan.

6. Miscellaneous causes.
   a. Mixing sexes.
   b. Change from machine to hand labor, or vice versa.
   c. Overtime or increased working hours.

Eliminating the Variances

Monthly comparisons of actual and standard costs enable management to concentrate its attention on those items which are of greater significance and frequently to refine processes or methods as a result of the disclosures. The figures furnished by the cost accountant enable management to isolate and correct conditions that cause higher or lower than standard costs. How far the data need be broken down depends on the individual case. It is emphasized, however, that the figures be interpreted and analyzed in language the supervisor and operator understand.

Management must nececssarily take steps to correct the conditions demanding attention, as evidenced by the reports submitted by the cost accountant, if the value of standard costs is to be maintained. Naturally, management looks to the industrial engineer to correct the malconditions or to see that they are investigated and the conditions causing the variance remedied. Why the industrial engineer? Because he is a fact-finder and interpreter of facts, and because intelligent action should be based on an unprejudiced analysis for remedying the causes of variances. The comparison against standard equips the engineer with facts; without standards, he works largely by opinion. In other words, the industrial engineer is essential in modern scientific costing. He supplements but does not replace the cost accountant.

It is the work of the cost accountant to search out all the causes of loss in efficiency, to give advice concerning cost trends, and to present these facts in the form most suitable for the plant and organization concerned. The analysis of costs at their source is a most important feature of control of variations or deviations from standard. The job analysis and the elimination of the variance is part of the work of the industrial engineer and usually falls within the categories outlined above.